

Coastal climate adaptation planning and evolutionary governance: Insights from Homer, Alaska

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ABSTRACT

Climate variability is not a new challenge for coastal communities. However, because climate variability is manifesting with more extreme climate impacts, occurring with greater frequency and with more intensity, the necessity for adaptation to minimize risk is becoming more pronounced. Though this is true of coastal communities around the globe, it is an acutely important concern for coastal communities in high northern latitudes, where the impacts of climate change are occurring at a disproportionate rate. With Homer, Alaska, as a case study, and through the lens of evolutionary governance, this research investigates coastal stressors (eg. storm surges, bluff instability) and subsequent decision dynamics around local government policy and planning for climate adaptation. In particular, the paper explores the relationship between actors and institutions, the connection between power and knowledge, as well as the challenges of path and goal dependencies. Narratives from key informants associated with Homer's climate change agenda highlight that while some stakeholders are keen to mainstream adaptation thinking into long-term strategic planning, adaptation policy remains a low priority (with a focus instead on mitigation). Uptake is further hindered by a belief among key decision-makers that the threat of climate change is a concern for the future. This in turn has resulted in diminished internal capacity (eg. institutions, knowledge) to effectively prepare for climate variability in general. Drawing insights through evolutionary governance theory, this study may provide coastal community decision-makers with an appreciation of the value (and nuanced challenges) of embedding climate adaptation thinking into strategic community planning.

1. Introduction

1.1. Climate change adaptation planning

As global temperatures continue to rise, climate change is featuring more prominently on government agendas (e.g. [7,14]). Though strategies for climate change mitigation dominate policy approaches (e.g. [3,8,50,11]), the importance of adaptation is gaining salience among governments from around the globe (e.g. [60]). This is echoed in the scholarship, where research highlights a shift from policies that focus exclusively on mitigation to those that view adaptation and mitigation as complimentary. Indeed, both are necessary in order to address the current impacts of climate change and lessen those in the future via a reduction in greenhouse gas (GHG) emissions [15].

With models projecting further variability in extreme weather events, e.g. intense precipitation/ drought, storm surge, and a rise in sea-level [36,67], some coastal decision-makers in particular, are coming to realize the growing threat. Risk is perhaps most pressing for

local government officials, as they represent the level of government nearest to the impacts, and importantly the communities being influenced by the changing climate [29]. Moreover, with cities expected to take in the majority of population growth over the coming years (e.g. Jones [17,38]), local decision-makers must consider how the dual challenges of growth and ageing infrastructure [16] will be compounded by an increasingly uncertain climate.

Yet, while there exists a clear need to include adaptation in local government policy (official community plans; setbacks, zoning, regulations) (e.g. [58,61]), climate change resilience is often eclipsed by other immediate needs [4]. Local efforts can be further hindered by shifting mandates and a general lack of direction from higher levels of government [40]. Leadership closer to home (i.e. Council) who deem the risks of climate change too uncertain or far into the future can also slow proactive action [51].

As the literature suggests, when an agenda for adaptation does exist, efforts often present as peripheral [41], and reactionary (or short-term) in nature, rather than mainstreamed with long-term strategic planning

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[32]. Additionally, while a flexible and coordinated policy approach is well suited to a complex and increasingly variable climate (e.g. [43,59]), coastal local authorities for instance, have a tendency to instead gravitate towards fixed hard solutions such as seawalls or rock armour [5]. As coastal communities continue to develop and densify their shorelines (e.g. [31]), reliance on such hard structures becomes costly. Further, while hard structures are tangible and visible to tax-payers, they may inadvertently provide a false sense of safety, and place those behind them at further risk (e.g. [24,59]).

The concept of resilience and what constitutes a resilient community is becoming prominent in scholarship around climate change preparedness (e.g. [46,56]). Historically, resilience linked to a system's ability to resist a disturbance (e.g. seawalls or rock armour). As the concept has evolved, resilience has come to assume change is normal; a resilient community or a resilient policy approach, for example, is thus one that can transform (or is flexible) and adapt to change [55]. While scholars debate what constitutes community resilience to climate change, specific stressors and discourse around planning for climate adaptation continues to receive less attention (e.g. [13,43]).

In an effort to contribute to the discussion, with Homer, Alaska, as a case study, the aim of this paper is to investigate coastal stressors (e.g. storm surge, intense precipitation) and subsequent decision dynamics around local government policy and planning for climate adaptation. Specifically, and framed through the lens of evolutionary governance, this research explores the relationship between actors and institutions, the connection between power and knowledge, as well as the challenges of path and goal dependencies.

Through the experiences of key informants linked to Homer's climate change agenda, this paper provides insight into the community's preparedness for climate variability. Additionally, given that Homer is not unique in its need to prepare for climate variability, findings from this research may provide communities experiencing like-climate stressors with awareness for the nuanced challenges of incorporating adaptation thinking with long-term strategic community planning.

1.2. Evolutionary governance theory

Recently emerging in the planning literature, evolutionary governance theory (EGT) offers a lens to better understand “the embedding of planning practices within a particular governance context” ([64], p.). Put simply, EGT provides a framework to explore how a specific approach to planning works in practice [6,65]. EGT acknowledges the complexity of governance, and accepts that planning systems are dynamic and contextually unique. Planning is intrinsic to governance, and governance is a function of actor-driven systems and practices, both evolving through time [66].

Community planning for climate change adaptation, or resilience, is deeply influenced by existing policies, plans and regulations and the actors responsible for their creation and implementation. Depending on their agenda, or understanding of the subject in general, an actor may facilitate or marginalize discourse on climate change. Indeed, decision-makers (e.g. senior administration) have the power to push proactive action on climate resilience. A lack of leadership (e.g. from Council), on the other hand, can stymie momentum around climate change thinking in general, or lock in policy that fails to adequately reflect the current state of environmental change (e.g. focusing on mitigation when adaptation is also necessary).

With intense precipitation, storm surges and sea-level rise projected to increase, climate change adaptation planning is becoming critical in coastal communities around the world. EGT provides a novel opportunity to explore the interactions of actors and institutions involved in community planning practice. This in turn, may help scholars better understand resolve for climate change adaptation within local government; and, provide local government leadership and decision-makers with insight into the value (and nuanced challenges) of embedding climate adaptation thinking into strategic community planning.

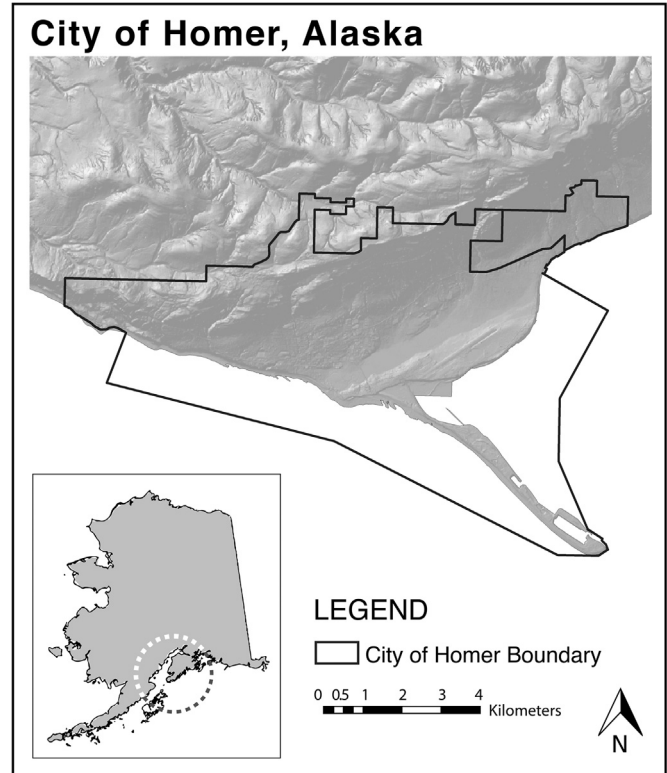


Fig. 1. The City of Homer, Alaska The following is the source information used by the author to create the map [10]: Coordinate System:NAD 1983 StatePlane Alaska 4 FIPS 5004 Feet; Projection:Transverse Mercator; Datum:North American 1983; Data Source: Kenai Peninsula Borough Alaska; Geographic Information Systems; Date Created: May 15, 2018.

1.3. Homer, Alaska

The challenges of climate change are particularly acute in the far north, where temperatures are rising faster than anywhere else on Earth [10,53]. In Homer, Alaska, a coastal community situated on the southern reach of the Kenai Peninsula (Fig. 1), for instance, mean seasonal temperatures have risen significantly since 1949:3.9 °C, 2.3 °C, 1.9 °C and 1.4 °C, for winter, spring, summer and autumn, respectively (converted from Alaska Climate Research Centre 2017). In addition to an increase in temperature, Homer has also experienced a rise in storm surge activity and intense precipitation [10,27]. This has made the Homer Spit and surrounding bluffs that characterize the community's landscape, key features which support considerable public and private assets, increasingly vulnerable.

Homer is a compelling case because it is the sole local authority in the State of Alaska that has confirmed its resolve for climate change resilience through a climate action plan [47]. Moreover, with a population of around 5000,¹ Homer provides an opportunity to investigate climate change stressors and policy response at a scale seldom explored in the literature [33].

2. Approach

The aim of this qualitative study was to be investigative and probing, and thus included semi-structured interviews with key informants associated with Homer's climate change agenda. This approach allowed for the generation of rich context specific narratives based on individuals' experiences around local climate change (e.g.

¹ <https://www.cityofhomer-ak.gov/community/facts-figures>, Accessed February 28, 2018.

[9,28,42]).

Key informants were selected purposively using criterion sampling. As climate resilience necessitates consideration of a variety of perspectives (e.g. [34,50,49]), and to increase the rigour of the research program in general, a variety of local informants and pertinent stakeholders were investigated, including:

- **Planners (3):** senior planners that could address governance surrounding climate risk identification and adaptation plan development, and how actions are incorporated into community planning;
- **Elected official (1):** city councillor that could provide insight into the community's long-term vision and general support for climate change actions; and,
- **Environmental stakeholders (4):** including environmental professionals and climate experts from the University of Alaska and the Kachemak Bay National Estuarine Research Reserve.

The interview protocol was designed to spur discussion around climate change impacts and vulnerability, and the nature of the community's climate adaptation policy response in particular. Questions were conceived with the intent to elicit a conversation, a jointly constructed, fluid dialogue between the interviewer and interviewee (e.g. [12]).

While narrative analysis was the chief approach, research also involved review of strategic planning documents (e.g. Climate Action Plan and All-Hazard Mitigation Plan, comprehensive plans, codes) and local news papers. As Engward and Davis [27] suggest, this serves to triangulate the findings and further enhance reliability.

In-person interviews ($n = 8$) and follow-up took place between August and December 2016. Interviews occurred on site in Homer, save three which took place in Anchorage (2) and Fairbanks (1). In all instances, the interview environment was comfortable and non-threatening to both interviewee and researcher alike (e.g. interviewee's office or boardroom).² Interview duration ranged from 40 min to 90 min. Following professional transcription, and in advance of data analysis, interviewees were provided time to review their respective transcript for accuracy and context. Once approved, transcripts were manually coded, and studied to discover emerging themes. In order to facilitate transparency and improve validity, the theme development process was clearly documented [54].

3. Results

The following section highlights first, how climate change impacts are affecting the community of Homer, Alaska, and then the community's policy response.

3.1. Key coastal climate impacts

Arctic temperatures have been increasing at a rate approximately $2\times$ global average over the past 100 years [35]. Warmer ambient temperatures have resulted in a number of climate impacts in northern coastal communities, ranging from insect infestation, flooding and drought, to acidification of coastal waters. In Homer, Alaska, according to the interviewees, the most concerning impacts include storm surge and intense precipitation.

3.1.1. Storm surge

With respect to storm surge, the interviewees were in agreement that the Homer Spit, with an elevation of approximately 7 m above sea level [62], is at the greatest risk (Fig. 2). A defining natural feature of the landscape, the Homer Spit projects 7.4 km into Kachemak Bay [23],

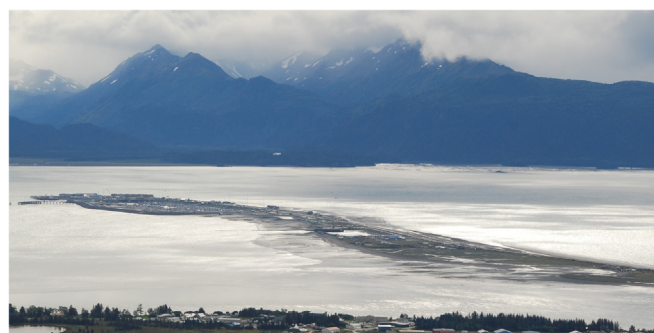


Fig. 2. The Homer Spit View of the Homer Spit, Homer, Alaska. Photo was taken by the author at low tide.

and is the site of numerous cultural, social and economic assets. For example, the Spit is the location of the community's first (non-native) settlement (1896) [22]. The Spit supports residential and commercial buildings, as well as campgrounds and an arena. Additionally, the Spit includes a thousand-slip harbour for deep and shallow draft vessels, along with a marine industrial complex (fishing, ice and fuel storage), ferry and cruise ship terminals, and coast guard facilities.

Characteristic of the land around Cook Inlet and the Kanai Peninsula, tectonic uplift resulting from glacial melt, has lessened the influence of sea level rise on the Spit [44,45]. However, according to the environmental stakeholders, an increase in occurrence and intensity of storm surge, particular those that occur in the Fall and concurrent with high tides, has resulted in extensive flooding. Shoreline erosion is also becoming more extensive and more pronounced along Homer's coast [57].

Along with general scouring of the sea-side of the Spit, foundations of many older buildings have become undermined, in some instances resulting in collapse. The Sterling Highway, which runs along the Spit, similarly experiences significant undercutting during storms [18]. Further, the planners highlighted that the lifespan of municipal infrastructure (pipes, boardwalks) has decreased, in some cases failing after a single season rather than years.

In addition to flooding and erosion, assets located on the Homer Spit are made further vulnerable when waves over-top the armour-stone seawall and launch boulders and logs onto the Sterling Highway. As the interviewees explained, this renders the highway impassable, effectively severing the sole road connection between the mainland and the Spit.

3.1.2. Intense precipitation

The interviewees highlighted variable precipitation as an important impact of climate change in Homer. In particular, a rise in intense rainfall events have become a concern. While intense rainfall typically occurs during the warm months, the environmental stakeholders emphasized that winter-month precipitation is increasingly manifesting as intense rainfall. Like a paved surface, frozen ground restricts infiltration, forcing rainwater to move quickly to the lowest point (the sea). When fast-moving water flows over the crest of a bluff, it breaks-down easily erodible sediment, threatening the bluff's stability. Indeed, the interviewees view the bluffs that surround the community as precarious, with rock falls and slumping ongoing concern (Fig. 3).³

Yet while the bluffs that surround Homer become increasingly susceptible to erosion, the lure for development exacerbates the risk further. In an effort to minimize risk, the Homer Zoning Code requires a setback of 12 m from bluff crest. However, through acquisition of a development permit, this restriction can be overcome ([21]: Chp. 21.44). Along with higher levels of impervious surfaces, bluff

² Before interviews could begin, a security and confidentiality form was signed by the interviewer and each interviewee.

³ In 2015, a section of Kachemak Drive collapsed, rendering the road impassable [2].



Fig. 3. Coastal bluffs Example of coastal bluff erosion in Homer, Alaska. Photo was taken by the author at low tide.

development often results in removal of vegetation, thus weakening the soil's natural anchor. Coastal bluff stability is made worse by stronger wave action as well, which can undermine the bluff and contribute to collapse.

In 2004, the Kachemak Bay Research Reserve conducted a coastal erosion study for the City. Research findings suggest an average rate of erosion of approximately 0.57 m per year, between 1996 and 2003 [62]. While the study did note risk along the Spit and the community's surrounding bluffs, it did not project erosion rates moving forward. Aware that continued intense precipitation will worsen bluff erosion, the planners and elected official are advocating for an update study.

3.2. Policy and planning actions

3.2.1. State of concern

While Homer is indeed influenced by climate change, many decision-makers within the city believe the community is not under immediate threat of dangerous impacts. The planners interviewed for this study concur that impacts will be moderate in Homer, however, they accept that circumstances can change rapidly. According to the elected official, the state of concern is further mellowed by a Council who's membership includes individuals that dismiss climate change as a phenomenon.

Nevertheless, while decision-makers and leadership downplay the climate change threat, the environmental stakeholders interviewed for this research drew attention to the variety of ways the community is being affected negatively by the changing climate. In addition to storm surge and intense precipitation for instance, variable precipitation both overwhelms stormwater infrastructure when intense rainfall occurs, and stresses freshwater supply in dry periods; transition to savannah-like terrain in conjunction with prolonged higher temperatures has increased the potential of wildfire; warmer, shallower water courses are challenging salmon spawning, and warmer waters in general are facilitating dangerous algal blooms, which threaten the shellfish industry. The environmental stakeholders suggested that the changing climate is in fact a concern, and that leadership and decision-makers should act now as it will become increasingly difficult to do so in the future.

3.2.2. Nature of integration

Though leadership and decision-makers view climate adaptation as a low priority, the City has released two strategic reports that offer the opportunity for further dialogue around resilience in general: The Climate Action Plan [19] and the All-Hazard Mitigation (A-HM) Plan [18]. The former was initiated by the Mayor, following participation in a conference, *Strengthening Our Cities: Mayors Responding to Global Climate Change*, in 2006.⁴ Not long after, the Global Warming Task Force (GWTF) was struck by Council.⁵ Composed of volunteer community

members and city managers appointed by Council, the GWTF's goal was to consolidate the community's path forward in an action plan.

The Climate Action Plan grew largely out of a desire to quantify and reduce GHG emissions, and improve energy efficiency in general. Moreover, like other communities throughout the United States, officials in Homer were spurred on by the failure of upper-levels of government to demonstrate leadership in this area [19]. Even though the action plan has a clear bias towards mitigation policy (e.g. energy savings), it does suggest that adaptation should be included in long-range planning. In this vein, the document includes four adaptation-related recommendations ([19], p. 37–38):

- The City of Homer will be proactive in helping to create a resilient local economy
- The City of Homer will take steps to protect existing infrastructure from the impacts of climate change
- The City of Homer will undertake emergency preparedness measures to reduce risks related to climate change
- The City of Homer will adopt wise policies for future development

In 2009, the Climate Action Plan Implementation Project Final Report was released. While the purpose of the report was to facilitate the actualization of recommendations made in the 2007 Climate Action Plan, actions for adaptation are absent [20]. One of the planners interviewed for this study commented “...we have documents that say we should plan for climate change [adaptation]... doing those things might not ever happen.” As the interviewee explained, efforts for mitigation, particularly around energy, are more palatable in Homer (then and now), as Council (and voters) can see a cost savings, rather than an expenditure. It is thus not surprising that since the plan was adopted, a number of energy and emission reduction-related actions have been actualized: establishment of a sustainability fund, energy upgrades, hybrid vehicles for fleet [63]. This also aligns with the Homer Comprehensive Plan, which discusses and prioritizes energy efficiency [22].

The A-HM Plan, likewise, does not incorporate climate adaptation into strategic long-term planning. A requirement under FEMA's Robert T. Stafford Disaster Relief and Emergency Assistance Act, the A-HM Plan demonstrates the City's process for risk and vulnerability assessment, as well as the rationale for prioritizing hazard mitigation efforts [18]. While the plan is near void of language around climate change thinking, it does discuss the risk of landslides and notes the value of proactively planning for flood protection, for example [18]. Moreover, the plan cautions development around steep slopes and highlights the need for further floodplain and drainage system mapping [18].

According to the interviewees, there is a growing discourse around resilience, and a growing acceptance internally that the City should incorporate climate adaptation into strategic planning. Momentum is challenged, however, by low decision-maker knowledge on climate change science and impacts in general. This is made even more difficult, as noted previously, by a lack of direction from Council. As a result, adaptation planning around climate change remains peripheral as an agenda and reactionary in execution: as one of the planners explained, when actions do occur “there is not much planning going into it”.

Compounding the challenge further, while city managers come around to the value of incorporating climate adaptation into policy and planning (e.g. regulations, codes, setbacks), one of the planners cautioned that buy-in within the community is still low: “people are going to have that push-pull... [individuals] like to have their freedom and will take the damage when it comes.” This is evidenced in an article in a local news paper, where the author explains that a homeowner would rather remain on an eroding bluff, then proactively relocate in advance of further risk [37]. Given that Council buy-in is largely a factor of community support, this suggests that it may remain difficult to gain the necessary leadership and decision-maker resolve to effectively mainstream adaptation into long-term strategic policy in Homer.

⁴ Held in Girdwood Alaska, September 2006.

⁵ This was made possible through approval of Resolution 06-141(A) in January 2017.

4. Discussion

4.1. Relationship between actors and institutions

At a basic level, actors are those that participate, either directly or indirectly, formally or informally, in community governance. Institutions, in the context of community governance, includes legislation and policies, as well as tools such as strategic plans that facilitate their integration and application within the community. For instance, an elected official or a decision-maker is an example of an actor, while a Comprehensive Plan or a Climate Action Plan can be considered an institution. Put simply, while institutions drive actions and the behaviour of actors, actors are responsible for creating and maintaining the institutions (e.g. [64]).

In Homer, actions around climate change are largely influenced by two key strategic planning documents. The A-HM Plan, for example, provides guidance on a range of environmental risks, however neglects to directly incorporate challenges associated with climate change. To be sure, though required through The Disaster Mitigation Act of 2000,⁶ as a requisite of receiving federal disaster mitigation funds, the content of the A-HM Plan is a function of what local government decision-makers and leaders deem a hazard [18]. In other words, if climate change impacts are not considered a hazard, they may not directly feature in the Plan. If however, the discussion were framed in the context of climate change, decision-makers could gain a better appreciation for the phenomena's exacerbating effect on existing environmental risks. In turn, a flexible long range policy response, that acknowledges future variability, could be developed.

The Climate Action Plan, while strongly climate change mitigation-focused, includes broad recommendation for inclusion of adaptation into long-range planning; nonetheless, the plan lacks language around implementation, which as the literature has shown, often results in actions failing to materialize (e.g. [61]). Again, like the A-HM Plan, the focus of the Climate Action Plan is not climate change adaptation, thus it is not necessarily a poor plan, perhaps merely a missed opportunity.

Indeed policy documents such as the A-HM Plan and Climate Action Plan provide an opportunity for anticipatory planning. However, as the interviewees suggest, when leadership and decision-makers fail to accept the existence of climate change, fail to understand the potential threat impacts may present, or fail to appreciate the value of integrating adaptation thinking with strategic policy in general, risk can be overlooked and recommendations for action often become marginalized.

As for the Homer Zoning Code, projected increases in climate variability and extremes are not considered. Moreover, when it comes to the most concerning impacts highlighted by the interviewees, storm surge and intense precipitation, the code provides opportunities for developers/ home owners to overcome institutional restrictions through development permits: in flood prone locations evidence of anchoring is required ([21]: Chp. 21.41); in steep slope zones, demonstration of sound engineering can overcome setback restrictions ([21]: Chp. 21.44). In fact, as one of the planners conceded, regulations “are’t the tightest” in Homer, noting that “[the City] is not into regulating away people’s use of the land.” Yet while local government is limited by its institutions, the community nevertheless expects city officials to provide protection from environmental risk (e.g. [48]). Frustrated, one of the planners offered that “the best [they] can do is make people aware [of the risk]”.

It follows, therefore, that if the City of Homer does not have the necessary institutions (plans, policies etc) to cope with climate change, decision-makers should create them. Unfortunately, because Council has not provided a mandate for action, and since City decision-makers largely hold climate change to be a benign risk at present, adaptation

has become a low priority. As indicated by one of the planners: “climate change is something we are not really paying attention to.” This is echoed in the scholarship, where it is suggested that a lack of political support can hinder forward-thinking action on adaptation (e.g. [50]). To be sure, where actions exist in Homer, in response to a storm surge for instance, the interviewees conceded that little proactive planning actually occurs.

As the literature suggests, the incorporation of concrete planned adaptations can improve a community's preparedness for climate variability and extreme weather (e.g. [43]). In the case of the Homer Spit, bolstered infrastructure in vulnerable, low and narrow stretches of land, could protect the highway and limit closures associated with surge events. Likewise a policy that prohibits development within steep slope zones could improve risk of bluff erosion and slumping associated with intense precipitation.

While councillors and senior administrators are the primary actors driving the creation of institutions within Homer, other stakeholders are working with various levels of management within the city to increase awareness about the community's vulnerability to climate change. For example, the Kachemak Bay National Estuarine Research Reserve delivers training programs to help actors understand the local-scale environmental stresses, and how these may influence day-to-day municipal work. Though certainly measured, one of the environmental stakeholders interviewed for this research offered that climate change adaptation is slowly gaining salience with some city managers. This suggests that perhaps the Reserve's efforts may begin to influence governance with a more climate adaptation-forward policy direction in the future.

4.2. Connection between power and knowledge

In the context of community governance, power can be thought of as indifferent, yet can influence decision making and shape how leaders and decision-makers understand their role within the community. Knowledge is a function of awareness for the variety of elements that affect community governance. Knowledge and understanding is important for power to facilitate effective governance. For instance, climate adaptation planning is a function of power; for adaptation to be a priority, those in power (councillors, senior administration) must accept the need to act (e.g. [64]).

While the need to incorporate climate adaptation into long-term planning is gaining ground with some city managers, others maintain that impacts will be moderate in Homer. Moreover, as in many other communities, some decision-makers in Homer cite uncertainty surrounding the nature of impacts as a reason to hold off action, adopting a wait and see approach instead (eg. [16,51]).

Action for climate adaptation is often stronger following a triggering event (e.g. [25]). However, Homer is not immune even at present. The risk associated with the Homer Spit and the community's surrounding bluffs for example, requires consideration and anticipatory planning in order to avoid poor land-use outcomes and expensive reactionary maladaptations (e.g. [39]).

Concern surrounding the difficulty of incorporating adaptation thinking with existing strategic policy has also presented a barrier. While mainstreaming of adaptation thinking does not necessarily require a paradigm shift in policy [41], it does require discourse and consideration during initial decision-making processes (e.g. [30]). However, in order for this to occur, a mandate from Council and support from senior administration is necessary. Otherwise actions for adaptation, such as those proposed in the Climate Action Plan, fall off the agenda (e.g. [4]).

Compounding the challenge further, Homer's Council includes members who continue to question the legitimacy of climate change in general. The pervasiveness of this kind of thinking is evident at the national level as well, with the Director of the Environmental Protection Agency denying the link between rising levels of

⁶ The Disaster Mitigation Act of 2000 (DMA 2000), Section 322 (a-d), as implemented through 44 CFR Part 201.6 [18].

atmospheric carbon dioxide and climate change (e.g. [27]). This emphasizes the importance of the power-knowledge relationship. Indeed, attitudes of climate change denial ultimately make it difficult to attract support, gain a mandate and fund adaptation efforts. At the State level for instance, in 2011, Governor Parnell dismantled the sub cabinet responsible for assessing climate change impacts and creating policies and actions around adaptation; between 2014 and 2017, the State's Department of Environmental Conservation had its budget reduced by 1/3 between [27].

Indeed, when the Alaska Climate Change Sub-Cabinet released *Alaska's Climate Change Strategy* in 2010 [1], an opportunity for collaboration between the State and local governments was created. With a focus on identifying vulnerabilities and attention to public infrastructure, natural systems, economic, health and cultural concerns, the report provides a resource for communities to understand their climate related risks, and insight into the State's path forward. However, with climate change now featuring low on the State's agenda, it is difficult to assess how the State will support local action on adaptation.

Perhaps foreshadowing future anticipatory local actions on adaptation, the City has an informal foreshore naturalization program. Though not explicitly linked to climate change resilience, the effort endeavours to minimize coastal risk by transitioning waterfront and riparian property to public open space for passive recreation. The intent of the program is to assist with stormwater management [22], as opposed to climate change adaptation, and therefore it enjoys broad leadership and decision-maker (and even coastal private property owner) support. Regardless, a program of coastal naturalization will serve to reduce the community's exposure to the impacts of climate change (including SLR, surges, erosion, slumping) (e.g. [38]). Support for the naturalization program may even facilitate Council and senior administration buy-in for other proactive actions related to environmental resilience.

4.3. Challenge of path and goal dependencies

Path and goal dependencies speak to historically imposed restrictions on governance. While restrictions can facilitate efficiency and provide focus, restrictions can also limit outcomes moving forward, and impede progress. When a community selects a policy path to follow, whether for social or economic development, or climate change resilience, missed opportunities and blindspots are sometimes created in the planning process, which can impact planning actions (e.g. [64]). In the city of Homer, leadership and decision-makers have gravitated towards a climate change policy path that focuses on mitigation, with the goal of reducing GHG emissions and improving energy efficiency [19], rather than one that prepares for the impacts of climate change (adaptation).

To be sure, a bias for mitigation over adaptation policy is common in the literature (e.g. [3]). However, a focus exclusively on mitigation and energy efficiency leaves coastal communities like Homer vulnerable to the physical impacts of climate change. For instance, in Homer, infrastructure along the Spit succumb to storm surges and flooding, and properties above the bluffs slump towards the sea. Indeed, scholarship suggests that many communities are transitioning away from an agenda that focuses just on mitigation, to ones that recognize the value of proactive adaptation as well (e.g. [15]).

In the near-term, in an effort to help the landscape resist environmental stress, decision-makers in Homer have implemented an ad hoc program of hardscaping; the seaside of the Spit has been heavily armoured with stone, and sections of bluff have been reinforced at the base with retaining walls and seawalls. While this effort demonstrates clear (perhaps even proactive) action, it invariably requires costly maintenance [16,18] and may have the effect of creating complacency (e.g. [24]), which ultimately impedes progress towards community resilience.

The Climate Action Plan reached its ten-year anniversary in 2017.

Since then the Kachemak Bay National Estuarine Research Reserve has taken a lead role in pushing the climate change adaptation agenda in Homer, with the intent of breaking the dependency (or strict focus) on mitigation. Through a series of adaptation planning public workshops, the Reserve hopes to help increase general awareness around scenario planning and adaptation strategy best practices [63].

With the next iteration of the action plan on the horizon, the Reserve believes this method may help generate momentum, and gain the necessary buy-in from Council and senior administration to include a stronger emphasis on adaptation in the new plan. Greater attention to adaptation may in turn facilitate the integration of such thinking into long-term strategic planning in general (e.g. expanding the informal foreshore naturalization program, strengthening the Homer Zoning Code and lowering asset density on the Spit). This could go some way to broaden policy focus and thus minimize missed opportunities associated with a path that is largely mitigation-centred.

In the end, climate change resilience shouldn't be about prioritizing a policy for climate change adaptation over mitigation or vice-versa, but rather to view the two approaches as mutually reinforcing and necessary in order to reduce community vulnerability moving forward. Indeed, a balanced approach can provide decision-makers with greater flexibility, and/ or a more dynamic response to climate change resilience.

5. Concluding thoughts

Climate variability is not a new stressor for coastal communities in the north. However, because the variability is presenting with more extreme climate impacts, occurring with greater frequency and with more force, the need for adaptation to minimize risk is becoming more apparent to many northern communities. Drawing on the experience of Homer, Alaska, and through the lens of evolutionary governance, this study explores the interplay between the various actors that shape policy and planning around climate change adaptation, the role of power and knowledge, as well as the challenges of path and goal dependencies.

Findings suggest that the local authority lacks the necessary institutions to effectively build climate change resilience into the community - key policy documents designed to guide planning for environmental stressors only minimally discuss climate change, and zoning codes lack the force necessary to discourage or prohibit development in vulnerable areas. Furthermore, while some acknowledge the need to mainstream adaptation thinking with strategic long-term planning, Council buy-in for action is low. As a result, adaptation remains a peripheral agenda, with a focus instead on climate change mitigation, a path considered by Council to be more palatable. Yet while leadership and decision-makers considers climate change impacts too uncertain to motivate response, storm surge and flooding threaten infrastructure located on the Spit, and intense precipitation weakens bluff stability.

Though limited to the experience of key actors in Homer Alaska, this study identifies local stressors and provides coastal community decision-makers with an appreciation of the value (and nuanced challenges) of embedding climate adaptation thinking into strategic community planning. With populations continuing to concentrate on the world's coasts (e.g. [52]), the need for proactive and integrated adaptation planning has increased in importance. While this may trigger philosophical considerations (e.g. our relationship to the Sea, for example), it certainly has practical implications as well (e.g. infrastructure, economics, emergency management). However, until leadership and decision-makers can fully appreciate that persistent extreme weather and climate variability is the new normal, it will remain difficult for communities to implement an agenda for climate change adaptation.

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Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the University of Alberta's Human Ethics Committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Disclosure statement

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